

dener nor I have heard any voice.—[The large long-necked tortoise *fuffs* like a cat very often.]

I remain, dear Sir, yours very truly,
 Dr. Johnston. PATRICK NEILL.

MY DEAR SIR,

Canonmills, Feb. 25, 1845.

The *Phrynosoma*, I regret to say, unexpectedly died about a week ago. I am not aware of having been able to make any observations in addition to those I formerly communicated.

We had a chamber made for it just over the entrance of the flue, and where the temperature was scarcely ever so low as 60° F., and often 70° and upwards: we kept a shallow saucer with water in the chamber, and always some *Hypnum* moss or foreign *Lycopodium* laid over the saucer, so that the lizard could drink and could not overturn the vessel or spill the water. The creature often sat on the top of the moss.

Dear Sir, yours very truly,
 Dr. Johnston. PATRICK NEILL.

XVIII.—On the Relations of the genus *Noggerathia* to Living Plants. By M. ADOLPHE BRONGNIART*.

THE difficulties in determining the relations of fossil plants to those now in existence have long been known. The isolation of the different parts of a plant, and in most cases their imperfect state of preservation, which obliges the naturalist to be satisfied with the examination of characters which are frequently the least important, are the principal obstacles to this study. The more the plants, the remains of which are submitted to our investigation, differ in their organization from those which are the constant studies of the botanist, so much the more difficult is the establishment of their analogies. The further we proceed in the series of ages towards the earliest geological periods, the further are we removed from the actual creation, and the greater do the differences between the living and fossil beings become; this general law is well-established in the animal kingdom, and it is not less true for the vegetable world.

Thus most of the fossil plants of the tertiary strata belong to genera in actual existence, and merely present specific differences; such are the pines, elms, birches, maples, walnut-trees, *Nymphææ*, &c.

Those of the secondary strata may undoubtedly almost always be referred to known families, but appear in most cases to require the formation of new genera.

Lastly, in the older strata, particularly in the coal-formations,

* Translated from the Comptes Rendus for December 29, 1845.

many of the fossil plants cannot be classed in families at present existing, and ought to constitute new groups of equal importance. The *Calamites*, *Lepidodendra*, *Sigillaria*, and *Asterophylleæ*, are thus situated; several less well-known genera should probably also be raised to the rank of distinct families. But above the families are the classes and the large divisions of the vegetable kingdom, and it might be asked whether those families which are peculiar to the primitive vegetation of the globe, and which are so different from those which now inhabit it, would enter into the present great divisions of the vegetable kingdom, or whether some of them should be referred to one of an entirely distinct nature, as it were, foreign to the great types of living vegetable organization. This important question cannot probably be solved with certainty in the present state of our knowledge of these fossils. However, all the observations which have hitherto been made appear to show that the earlier creation must be referred to the principal types of the present creation, but without presenting examples of them all. Thus the present vegetable kingdom presents five great divisions: the Cellular Cryptogamia or Amphigens, the Vascular Cryptogamia or Acrogens, the Dicotyledonous Phanerogamia, Gymnospermia and Angiospermia, and the Monocotyledonous Phanerogamia. The first three of these great divisions undoubtedly existed at the period of the coal-formation, whilst the two latter appear to have been completely absent; at least, we have no positive evidence of their existence; whilst, on the other hand, everything tends to render it doubtful. On this point recent researches have merely confirmed what I established more than twenty years ago, *i. e.* the absence of the angiospermous dicotyledonous Phanerogamia, and even that of the monocotyledons, the existence of which then appeared to me very doubtful. But new and hitherto very rare specimens which have been collected and carefully studied in England, Germany and France have caused important changes relative to the plants which I had considered as Acrogens or vascular Cryptogamia. This advance is owing to the discovery of portions of stems of these plants with the internal structure in a state of preservation. They have shown that the *Sigillaria*, *Stigmaria*, and probably most of the *Calamites*, are not plants nearly related to the Ferns, Lycopodia and Equiseta, but to distinct families of the dicotyledonous gymnospermous group, more nearly approaching the *Conifera* and *Cycadeæ*.

Hence, at the period of the coal-formation, vegetation would have consisted entirely, or nearly so, of two of the great divisions of the vegetable kingdom: the acrogenous Cryptogamia, represented by the herbaceous and arborescent Ferns (the latter reduced to the true *Caulopteris*), the *Lepidodendrea*, a family nearly re-

lated to the *Lycopodiaceæ*, and some *Equisetaceæ*; and the gymnospermous dicotyledons, comprising the *Sigillariæ* (*Sigillaria*, *Stigmara*, *Lepidofloyos*), the *Calamitaceæ* (*Calamites*), the *Coniferæ* (*Walchia*), and probably the *Asterophylleæ* (*Asterophyllites*, *Annularia* and *Sphenophyllum*). We thus see of what great importance the latter branch of the vegetable kingdom, which is so limited in the present vegetation, appears to have been at this early period. The families which belong to it are moreover still the most obscure, and such as deserve most to receive the attention of botanists. The characters of most of them are merely founded upon the form and structure of the stems, and we are in general unacquainted with the form of their leaves and fructification.

The genus to which I now propose to draw attention is unknown to us except by its leaves; but I believe that I can refer organs of fructification to this genus, establish by this means its relations to recent plants upon a solid basis, and show that it closely approaches a family of the gymnospermous dicotyledons still in existence, the *Cycadeæ*.

M. de Sternberg* has given the name *Noggerathia foliosa* to an impression of a leaf from the coal-formations of Bohemia. At first he did not point out any relation between these plants and those at present existing; subsequently, by comparing them to the leaves of *Caryota*, he placed them near the Palms, and more recently he arranged them among the monocotyledons, without fixing their position. At a period when I was unacquainted with this fossil except from the figure of M. de Sternberg, I admitted the analogy of these leaves with those of *Caryota*. Mr. Lindley, and quite recently M. Corda, still admit this position of *Noggerathia* among the Palms. On the contrary, M. Unger † and M. Goeppert ‡, as I presume, have classed this genus among the Ferns. Which is the most probable of these opinions? Are there not more intimate relations between this fossil plant and other living plants? We shall examine this point. We may first remark, that the genus *Noggerathia* is not confined to the single very rare species at first described by M. de Sternberg, and which has only hitherto been found in the coal-mines of Bohemia. Messrs. Lindley and Hutton long since added *Noggerathia flabellata* from the Newcastle mines to this genus. M. Unger enumerates, in addition, two species described by M. Goeppert, and I have made known two from the Permian sandstone of Russia in Messrs. Murchison and Verneuil's large work. I should add,

* Flore du Monde Primitif, fasc. 2. p. 32. t. 20.

† Synopsis Plantarum Fossilium.

‡ Genres des Plantes Fossiles, livraisons 5 et 6 (quoted by M. Unger). This livraison has not yet arrived at Paris.

that the examination on the spot of several vegetable impressions upon the schists and sandstones from the coal-mines of France, and the transmission of important collections made in these mines by the superintending engineers, have made me acquainted with several new species of this genus. Several beautiful specimens, and the examination of a large number of fragments, have convinced me that most of these species were much larger than those at present known, especially the species first described by M. Sternberg. Generally we merely find isolated leaflets of the large pinnate leaves of these plants; and even more frequently fragments only of these leaflets, which require to be reconstructed at the localities by joining the different portions contained in the slabs.

We thus find that the true *Noggerathia* have pinnate leaves with more or less expanded cuneiform leaflets, which are sometimes fan-shaped, at others almost linear, truncated or rounded like a spatula at the summit, frequently cleft into straight or linear, truncated or rounded lobes. These leaflets generally terminate obliquely at the summit, which indicates, even when they are isolated, that they are leaflets of a pinnate leaf and not simple leaves. Their most important character consists in the arrangement of the nerves. These all arise from the tolerably large base of the leaflet; they are perfectly equal in size, hence the leaflets do not present any median nerve, nor any predominating secondary nerves; arising from the base of the leaflet, they are parallel to each other, or slightly divergent, according to the more or less expanded form of these leaflets; they either remain simple or bifurcate by an insensible duplication, and not by a decided bifurcation as in the Ferns. Hence it results that these nerves are slightly stronger towards the base, more slender towards the centre or the extremities of the leaflets, but all uniform, and thus reach the truncated or rounded extremity of the leaflets. Such are the structural characters of these leaves, which may assist us in appreciating their relations to the leaves of living plants.

It is evident that the relations established between the *Noggerathia* and the Palms are badly founded; for in all the palms which have cuneiform truncated leaflets (*Caryota*, *Harina*, *Martinezia*, &c.), as in those having linear or lanceolate leaflets, there is a more marked median nerve, then some more slender secondary nerves, and finally some very delicate nerves between these; hence the nerves are very unequal, and the median nerve especially is nearly always very distinct.

In the ferns with pinnate leaves, the leaflets of which slightly approach those of *Noggerathia* in form, the nerves also arise from a very distinct median nerve, at least towards the base; more-

over, they are dichotomous with a bifurcation which is distinct, and forms a very obtuse angle. A few ferns only having a simple flabelliform frond, present a structure tolerably analogous to that of the leaflets of *Noggerathia*: such are *Schizea latifolia* and *elegans*, but the general form of the leaf is very different.

These structural characters of the leaves appear to exclude all real analogy of the fossil plants which we are considering with the two families, the Palms and Ferns.

But there is another family very widely diffused among the primary creations of the vegetable kingdom, which presents a much more marked analogy with *Noggerathia* in the structure of its leaves; it is that of the *Cycadeæ*. We know that the *Cycadeæ*, long since placed by botanists sometimes near the Ferns, sometimes the Palms, have been considered by all recent authors, especially since the beautiful publications of L. C. Richard and Du Petit Thouars, as intimately allied to the *Coniferae*, and forming with them the remarkable group of gymnospermous dicotyledons. But if the *Cycadeæ* and *Coniferae* are united by the most important points in their organization, they differ extremely in their general aspect, in which the *Cycadeæ* resemble the Palms. Like them, the *Cycadeæ* have pinnate leaves with linear lanceolate or oblong and almost spatulate leaflets. However, the structure of these leaflets is very different in these two families. In *Cycas* they are traversed by a single median nerve; on the contrary, in *Zamia*, and especially in the American *Zamia*, each leaflet is traversed by slender and numerous nerves, which are of perfectly equal size, arise directly from the base of the leaflet, simple and parallel when the leaflet is linear or oblong, slightly divergent and bifurcate at a very acute angle when the leaflets are obovate or spatulate. In short, the neuration is exactly the same as that of *Noggerathia*. The general form of these leaflets is also very analogous when we compare certain species of *Noggerathia*, such as *N. foliosa* and *spatula*, with some species of American *Zamia*, as *Zamia furfuracea*, *integrifolia* and *pygmæa*. Other species are further removed from the existing *Cycadeæ* by the form of their leaflets; but the characters of the neuration remain the same, and their importance is evidently much greater than that of the form of the leaves. Thus the *Noggerathia* appear to me clearly to approach the *Cycadeæ* in the structure of their leaves, and to belong to the division of the gymnospermous dicotyledons. But the *Cycadeæ* and the allied families are frequently arborescent plants, furnished with both male and female flowers, and with seed of a considerable size. May we not find portions of these organs in the strata in which *Noggerathia* occur, which would confirm and more accurately determine the affinities of these plants?

One of the best means of removing some of the difficulties in the study of fossil plants, and especially of withdrawing part of the veil which still obscures the affinities of the plants in the coal-measures, appears to me to consist in studying, in the mines themselves, the manner in which the various forms of fossil plants are associated in the rocks which accompany the same layer of coal. In fact, in my opinion, each stratum of coal is the product of a peculiar vegetation, frequently different from that which precedes and that which follows it,—vegetations which have given rise to the superior and inferior layers of coal; each stratum resulting, in this manner, from a distinct vegetation is frequently characterized by the predominance of certain impressions of plants, and the miners in numerous cases distinguish the different strata which they remove by the practical knowledge they possess of the accompanying fossils. Any layer of coal and the rocks which lie upon it should consequently contain the various parts of the living plants at the moment of its formation, and by carefully studying the association of these various fossils, which form so many special floras, containing generally but few species, we may hope to be able to reconstruct these anomalous forms of the ancient world. This is what I have applied myself to in my travels during the last two years, with the view of studying the coal strata of part of France and the fossil plants which they contain; and although similar results cannot generally be obtained except by long-continued researches, which the directors of mines alone could make, still chance has sometimes favoured me, and furnished me with useful materials for the solution of this important question. Thus, in the mines at Bessège, near Alais, I was astonished at finding amongst the portions removed from one gallery and from the same stratum, a large number of the following fossils, which were almost unmixed with others:—1. Numerous fragments of the leaves of *Noggerathia*, with long, almost linear leaflets, which were slightly cuneiform and lobed at the summit; 2. Other fronds of a crested form, and having a very characteristic aspect; 3. A large number of large elliptic or oblong seeds. These remarkable fronds, of which I had met with rather small fragments only, but of which I have since seen almost perfect specimens in other mines, in the species at Bessège, which is the largest I am acquainted with, would be about 50 centimetres long and about 30 broad. They are bipinnatifid, the petiole and rachis large, flattened, expanding as they penetrate the secondary rachides, and from thence into the rounded, recurved and fringed lobes, which constitute the foliaceous appearance. This part has not in the least the aspect of the delicate and well-defined leaves of the ferns, which are so common in these strata; in this it is rather a flattened, dilated petiole, thinner and

lobed at the margins; and there is no small leaflet inserted upon these flattened rachides; hence we cannot suppose that it is the young frond of a fern still convoluted at the extremity. I ought moreover to remark, that these fronds do not constitute a unique and exceptional case, but are extremely abundant in this stratum.

After having compared these impressions with all the foliaceous organs with which I am acquainted, I find none to which they have more analogy than those abortive fronds, which in *Cycas* bear the organs of reproduction. These modified fronds of *Cycas*, which are much shorter than the true leaves, support on their base and on the two sides of the petiole, two, three or four tolerably approximated ovules; towards the extremity they expand into a thick lamina, which is slightly dilated and almost entire in *Cycas circinalis*, very large, and deeply cut into narrow laciniae in *Cycas revoluta*.

There is certainly a great difference both in the shape and details of the form of these organs and those to which I compare them, but their general structure appears to me very analogous; and when we recollect that the leaflets of *Cycas* are spirally convoluted in their young state, like the lobes of this singular frond; when we remember that *Noggerathia*, and particularly the species which accompanies it, has much larger leaflets than those of *Cycas*; finally, when we find these fronds associated with leaflets having so many characters common to the other *Cycadeæ*, we are led to believe that these anomalous fronds are the abortive and fructiferous fronds of *Noggerathia*. This supposition is confirmed by the presence of large quantities of fruits, or rather seeds, which resemble those of *Cycas* most strikingly, in the same strata which contain these two kinds of fronds. These are large oblong or ellipsoidal seeds, flattened by compression, perfectly symmetrical, thicker, and as it were truncated towards the base at the point corresponding to the chalaza, more acute at the summit, and frequently towards this extremity presenting traces of an internal body which appears to indicate the position of the micropyle and the attachment of the embryo.

It is difficult to avoid being struck by the analogy in form and structure of the appreciable parts of these seeds with those of the *Cycadeæ* and certain *Coniferæ*, such as the yew and the ginkgo. But they present the most marked relations to the true *Cycadeæ* in form and size.

Hence we find combined in a single layer of one coal-mine, and frequently in the same pieces of sandstone or schist:—1. Leaves, the leaflets of which have the form and nervation of those of certain existing *Cycadeæ*, especially the American *Zamia*; 2. Leaves of a peculiar form, having however a well-marked analogy with the modified leaves which bear the fruit in certain

Cycadeæ, especially *Cycas revoluta*; 3. Seeds, having the most striking resemblance to those of *Cycas*. It is difficult to avoid drawing the conclusion that these three kinds of organs belong to one plant, and that this plant should be placed very near the *Cycadeæ*, probably even in the same family, in which it would form one of the most remarkable genera from the large size and form of its leaves,—a genus which would appear to combine leaves analogous to those of *Zamia* with a mode of fructification similar to that of *Cycas*. I should add, that this association, which appeared to me so striking in the mines at Bessège, from the abundance of these fossils, appears to exist in several other mines where these fossils are more rare. Thus in those of Treuil at St. Etienne we also find large leaves of a species of *Noggerathia*, probably different from that of Bessège, associated with fronds having pinnatifid fringed lobes, which are however not recurved as those in the former locality, and having analogous fruits to those above described, although slightly different specifically. In Decazeville we find the same association, although combined with some specific differences and smaller dimensions in all the parts. I possess leaves of a peculiar species of *Noggerathia* obtained by M. Boisse from Carmeaux, in the fragments of which I can now recognise lobes of these abortive fronds very analogous to those of St. Etienne; finally, two kinds of seeds having considerable analogy with those which I have attributed to *Noggerathia*, although very different in their proportions. Leaves of *Noggerathia*, although from different species, are also very abundant at Blanzay, in the basin at Autun, at Brassac, Commentry, Saint-Gervais, Neffiez, Saint-Georges-sur-Loire, Saint-Pierre-la-Cour and Anzin.

Most of the straight, linear or slightly cuneiform leaves, having equal and parallel nerves, and called *Poacites*, appear to be leaflets or lobes of the leaflets of *Noggerathia*; however, these leaflets having almost always been found only isolated, and also in very imperfect fragments, we must not generalize too much on their relations with *Noggerathia*; probably several belong to another genus of the same division of the vegetable kingdom, *Flabellaria* of M. de Sternberg, also referred by this savant to the family of Palms, and the affinities of which, both to the *Coniferæ* and to the *Cycadeæ*, have been shown by M. Corda; but here the leaves are simple and symmetrical, whilst in *Noggerathia* the foliaceous parts consist of the leaflets of a pinnate leaf, and they are generally oblique at the summit and not symmetrical.

This determination of the position of *Noggerathia* in the vegetable kingdom is not without some interest, for these plants appear very numerous and widely diffused in the coal-formation, and the debris of their leaves appears in some places, by their

accumulation, to have contributed essentially to the formation of the coal.

We may moreover remark, that this genus being excluded from the monocotyledonous division; *Flabellaria borassifolia* of M. de Sternberg, from the coal-mines of Bohemia, being also rejected from the family of the Palms to be arranged with the gymnospermous division; and the genus *Artisia* appearing to be similarly situated; a few fruits only remain in these ancient strata to represent this large division of the vegetable kingdom, and the structure of these is too imperfectly known to allow of our placing them with any probability in this natural division, when we are unacquainted with either their stems or leaves.

Hence everything leads us to conclude from the researches which have hitherto been made, that the terrestrial vegetation of the period of the coal-formation was limited to two of the large divisions of the vegetable kingdom—the acrogenous or vascular Cryptogamia, and the gymnospermous dicotyledonous Phanerogamia.

XIX.—*Characters of some undescribed species of Chalcidites.*

By FRANCIS WALKER, Esq., F.L.S.

1. *Chalcis Alphius*, mas et fem. *Nigra, antennis nigris, pedibus flavis nigro et piceo cinctis, metafemoribus rufis flavo-variis aut nigris, alis limpidis.* (Corp. long. lin. 2—2½; alar. lin. 3½—4.)

Male.—Body black, convex: head and thorax punctured: head nearly as broad as the thorax; vertex broad; front impressed: antennæ black, filiform, nearly as long as the thorax: prothorax transverse, subquadrate: scutum very large; sutures of the parapsides distinct; axillæ remote from each other; scutellum obconic, having a rim behind: propodeon obconical, declining, rugulose: podoon very short: abdomen smooth, shining, narrower and much shorter than the thorax; metapodeon occupying more than half the dorsum; octoon and following segments short: legs yellow; coxæ black; profemora and mesofemora black, their tips yellow; metafemora red, thick, partly yellow on the outside and armed beneath with nine or ten little black teeth; protibiæ encircled with red; mesotibiæ encircled with a piceous band; metatibiæ curved, piceous at the base and in the middle; tips of the tarsi piceous: wings limpid; squamulæ yellow; nervures fulvous; humerus much less than half the length of the wing; ulna not half the length of the humerus; radius more than half the length of the ulna; cubitus hardly half the length of the radius; stigma very small.

The colour of the legs varies; the protibiæ are sometimes red; the mesotibiæ black, yellow at the base and at the tip; the metafemora altogether black; the nervures of the wings piceous. The antennæ